DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] About the rotating polygon used as reflecting mirrors, such as a copying machine, facsimile, and a laser beam printer, this invention is excellent in a mechanical strength and endurance, and relates to the metal rotating polygon of a high reflection factor which suppressed dispersion in a reflection factor.
[0002]
[Description of the Prior Art] Conventionally, there are things, such as a (b) explained below as a metal rotating polygon and a (b).
[0003] (b) What anodized the cutting mirror plane of the rotating-polygon base which consists of aluminum or an aluminium alloy, generated the transparent coat, and was used as the mirror-plane protective coat (refer to JP,58-184903,A).
[0004] (b) What formed the thin film of at least the metal thin film which has a high reflection factor, and a two-layer dielectric one by one on the mirror plane of the rotating-polygon base which consists of a metal (refer to JP,60-195502,A).
[0005]
[Problem(s) to be Solved by the Invention] It is an average reflectance among the above-mentioned Prior arts, and a (b) is about 85%. If impurities, such as Si, exist in a rotating-polygon base etc. when forming an oxide film on anode in the base which cannot say it as sufficient reflection factor, in addition consists of aluminum or an aluminium alloy, in order to attain improvement in the speed of a copying machine, a laser beam printer, etc. Since a possibility that a pit-like defect may arise is in an oxide film on anode, since the aforementioned aluminum and an aluminium alloy need to consider as the thing of a high grade, the price of rotating-polygon base material becomes expensive, and they cause cost quantity.
[0006] Moreover, it is inferior to that a pit-like transformation point arises on a front face when it took out after leaving it for 100 hours in the high-humidity/temperature environment of 85% of temperature relative humidity of 70 degrees C, for example, while a blemish tends to be attached, when the mechanical strength of the front face of a metal rotating polygon is low although the reflection factor became high in a (b), and surface dirt is wiped away, and the surface state was observed, etc. and the resistance to environment.
[0007] this invention is made in view of the technical problem that it does not solve [which the above-mentioned Prior art has], and aims at realizing the metal rotating polygon which has the high reflection factor excellent in the surface mechanical strength and the resistance to environment
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the rotating polygon of this invention On the mirror plane of the rotating-polygon base which consists of aluminum or an aluminium alloy It is the metal rotating polygon in which the interlayer, the metallic reflective layer, and the protective layer were formed one by one. A 50nm or more thickness [100nm or less] chromium layer and the aforementioned metallic reflective layer A 100nm or more thickness [150nm or less] copper layer, [the aforementioned interlayer] The aforementioned protective layer consists of a 150nm or more thickness [200nm or less] aluminum-oxide layer, and it is characterized by the operating wavelength being 640nm or more.
[0009]
[Function] Since the 50nm or more thickness [which is an interlayer / 100nm or less] chromium layer was prepared between the mirror plane of aluminum or the rotating-polygon base made from an aluminium alloy, and the 100nm or more thickness which is a metallic reflective layer / 150nm or less] copper layer, the adhesion of the aforementioned mirror plane and the aforementioned metallic reflective layer will become firm. moreover, an increase since the reflection factor of the aforementioned copper layer is 90% or more to a beam of light with a wavelength of 640nm or more -- a reflecting layer -- it is not necessary to form
[0010] Furthermore, since it becomes that the surface mechanical strength excelled [that] in the resistance to environment highly since the 150nm or more thickness [200nm or less] aluminum-oxide layer was prepared as a protective layer, while surface hardness protects the front face of the low aforementioned copper layer comparatively, it also has the operation which suppresses dispersion in the reflection factor to a beam-of-light incident angle. In addition, even if it is the case where membranes are formed by the usual vacuum deposition method, a filling factor is 0.95 [higher than other dielectrics], and while the gaseous interception nature of oxygen [a steam oxygen, etc.] in air which has a copper front face and reactivity improves, since aging of a refractive index is also small, decline in the refractive index of a reflecting layer with time is

suppressed.
[0011]
[Example] It explains referring to the example of this invention on a drawing.
[0012] Drawing 1 is the type section view showing the abbreviation half of the metal rotating polygon of one example of this invention.
[0013] As shown in drawing 1 , the product made from aluminum or the rotating-polygon base 1 made from an aluminium alloy is eight face pieces, and the mirror plane is formed in the peripheral surface of cutting etc. On the aforementioned mirror plane of the rotating-polygon base 1, the interlayer 2, the metallic reflective layer 3, and the protective layer 4 are formed one by one of the vacuum deposition method.
[0014] The thickness of an interlayer 2 is 50nm or more Cr layer 100nm or less. Endurance is inadequate in it being less than 50nm, if the thickness of Cr layer is larger than 100nm, a crack goes into a film and its vacuum evaporationo nature is poor.
[0015] The thickness of a metallic reflective layer 3 is 100nm or more Cu layer 150nm or less. A reflection factor falls that the thickness of Cu layer is less than 100nm, if larger than 150nm, vacuum evaporationo will take time, and productivity is bad.
[0016] For a protective layer 4, thickness is 150nmor more aluminum 2O3 200nm or less. It is a layer. aluminum 2O3 Optical properties, such as a reflection property including the incident angle dependency, become inadequate [endurance is inadequate in the thickness of a layer being less than 150nm, and], if larger than 200nm.
[0017] In the above-mentioned example, although the rotating-polygon base was made into eight face pieces, let them be polyhedrons not only this but other than 8 face pieces.
(Example 1) On the rotating-polygon base made from the aluminum of eight face pieces by which mirror-plane cutting was carried out, it is aluminum 2O3 of 150nm of thickness as Cu layer of 100nm of thickness, and a protective layer as Cr layer of 50nm of thickness, and a metallic reflective layer as an interlayer one by one. The layer was formed, respectively and the metal rotating polygon was obtained. The membrane formation conditions of the aforementioned interlayer, a metallic reflective layer, and a protective layer are as being shown in Table 1.
[0018]
[Table 1]

層	蒸着材料加熱方式	基板温度 (℃)	真空度 (Torr)	蒸着速度 (nm/sec)
中間層	電子ビーム	150	5×10^{-5}	3.0
金属反射層	Wボート抵抗加熱	150	5×10^{-5}	3.0
保護層	電子ビーム	150	1×10^{-4}	1.0

(Example 2) On the rotating-polygon base made from the aluminium alloy of six face pieces by which mirror-plane cutting was carried out, it is aluminum 2O3 of 200nm of thickness as Cu layer of 150nm of thickness, and a protective layer as Cr layer of 100nm of thickness, and a metallic reflective layer as an interlayer one by one by the vacuum deposition method. It formed and the metal rotating polygon was obtained. The membrane formation conditions of the aforementioned interlayer, a metallic reflective layer, and a protective layer are as being shown in Table 2.
[0019]
[Table 2]

層	蒸着材料加熱方式	基板温度 (℃)	真空度 (Torr)	蒸着速度 (nm/sec)
中間層	電子ビーム	100	5×10^{-5}	3.0
金属反射層	電子ビーム	100	5×10^{-5}	3.0
保護層	電子ビーム	100	1×10^{-4}	1.0

(Example 1 of comparison) If the example 1 of comparison is explained, as shown in drawing 2 , the rotating-polygon bases 11 made from aluminum by which mirror-plane cutting was carried out are eight face pieces, and, as for the peripheral surface, the mirror plane is formed. the aforementioned mirror-plane top of the rotating-polygon base 11 -- a vacuum deposition method -- one by one -- as an interlayer 12 -- as Cr layer of 50nm of thickness, and a metallic reflective layer 13 -- the increase of Cu layer of 100nm of thickness -- a reflecting layer -- as 14 -- aluminum 2O3 of 105nm of thickness as a layer and the best layer 15 -- TiO2 of 125nm of thickness The layer was formed and the metal rotating polygon was obtained. the increase of aforementioned interlayer 12 and metallic-reflective-layer 13 -- a reflecting layer -- the membrane formation conditions of 14 and the best layer 15 are shown in Table 3

[0020]

[Table 3]

層	蒸着材料加熱方式	基板温度 (℃)	真空度 (Torr)	蒸着速度 (nm/sec)
中間層	電子ビーム	100	5×10^{-5}	3.0
金属反射層	Wボート抵抗加熱	100	5×10^{-5}	3.0
増反射層	電子ビーム	100	1×10^{-4}	1.0
最上層	電子ビーム	100	1×10^{-4}	0.5

(Example 2 of comparison) If the example 2 of comparison is explained, as shown in drawing 3 , the rotating-polygon bases 21 made from aluminum by which mirror-plane cutting was carried out are six face pieces, and, as for the peripheral surface, the mirror plane is formed. It is aluminum 2O3 of 90nm of thickness as an oxide film on anode 22 on the aforementioned mirror plane of the rotating-polygon base 21. The layer was formed and the metal rotating polygon was obtained. The formation conditions of the aforementioned oxide film on anode 22 impress a direct current of 20V between the aforementioned rotating-polygon base 21 dipped into the solution of 15% of sulfuric-acid concentration of 18 degrees C of solution temperature as an electrolytic solution, and cathode, and are aluminum 2O3 of the above-mentioned thickness about the current of 1.5A. It energized until the layer was obtained, and the metal rotating polygon was obtained. Performance comparison was performed about the metal rotating polygon of each example and each example of comparison mentioned above.

[0021] About the performance evaluation of a reflection factor, the relation between the incident angle in the measurement wavelength of 675nm and the reflection factor of S-polarization is shown in drawing 4 , and the spectral reflectance of S-polarization component in the incident angle of 12 degrees is shown in drawing 5 .

[0022] The reflection factor of examples 1 and 2 is 95% or more, and even if an incident angle moreover changes, it has little dispersion in a reflection factor, so that clearly from drawing 4 . Moreover, the reflection factor to light with a wavelength of 640nm or more is 95% or more of high reflection factor so that clearly from drawing 5 . Next, it carried out about the quality performance evaluation by the test method which explains a resistance to environment, surface intensity, and a peel test below, respectively.

[0023] About the resistance to environment, after leaving each rotating polygon for 100 hours in the high-humidity/temperature environment of the temperature of 70 degrees C, and 85% of relative humidity, it took out and connivance check of appearance change and measurement of a reflection factor were performed.

[0024] A solvent (ether 70vol% : methanol 30vol%) is made to permeate a lens cleaning paper (for the product "DASUPA (R)" made from OZU to be used) about surface intensity, and it is the above-mentioned lens cleaning paper to a metal rotating-polygon front face 2 kg/cm2 After pressing and going ten times by the pressure, the existence of a surface blemish was checked by connivance.

[0025] About the peel test, it was made to stick to the front face of a metal rotating polygon, and the adhesive tape ("the Scotch tape (C)" by Nichiban Co., Ltd. is used) was lengthened promptly, and was removed, and the existence of ablation of the aforementioned front face was checked by connivance. The result of the above-mentioned examination is shown in Table 4.

[0026] In Table 4, the amount of change of the reflection factor by the degree of incident angle is the difference of the highest value of S-polarization reflection factor when changing from the degree of incident angle of 0 degree to 70 degrees in the wavelength of 675nm, and the minimum value.

[0027]

[Table 4]

	表面強度	耐環境試験(70 ℃85%RH)波長675nm			入射角度による反射率の変動量（%）	剥離テスト
		耐久後の外観	耐久前の反射率(%)	耐久後の反射率(%)		
実施例1	○	○	95．7	95．6	0．8	○
実施例2	○	○	96．3	96．3	2．3	○
比較例1	×	×	98．3	96．4	1．3	○
比較例2	○	○	85．4	85．3	3．1	○

The metal rotating polygon of each example is a high reflection factor, and its amount of change of a reflection factor is also small while it is excellent in a surface mechanical strength and a surface resistance to environment so that clearly from Table 4.

[0028]

[Effect of the Invention] Since this invention is constituted as above-mentioned, it does so an effect which is indicated below.

[0029] A surface reflection factor is as high as 90% or more, and the incident angle of a beam of light has the optical property which dispersion in S-polarization reflection factor became 2.3% or less within the limits of 0 to 70 degrees, and was excellent.

[0030] Moreover, since protective layers are a high filling factor and an aluminum-oxide layer of a high degree of hardness, a surface mechanical strength is excellent, in order to take dirt, when it does not wipe away a front face or a blemish etc. does not arise in the time of assembly etc., it excels in a resistance to environment, and with-time change of a refractive index is also small.

[Translation done.]